CPTG 445
Computer Architecture
Spring Quarter, 2024

Time and Location

Lecture: 4/1/2024 – 6/13/2024, MW 1:00 p.m. – 2:50 p.m., PSC 147.

Textbook (Required)

Computer Organization & Design, the Hardware/Software Interface, Patterson & Hennessy, Margan Kaufmann, 5th Ed.

Instructor

Dr. Hwang. Office PSC 255. E-mail: ehwang@lasierra.edu. Office hours: Email me anytime to make an appointment or if you have any questions. Appointments can be either in person in my office or on Zoom.

Course Description

Bulletin Course Description: Computer organization and architecture, RISC, pipelining, memory hierarchy, cache, virtual memory.

Prerequisite

CPTG 244 and CPTG 245.

Student Learning Outcomes

The computer science curriculum at La Sierra University provides opportunities to reach various goals under the broad mission statement: “To Seek, To Know, To Serve.” This upper division computer science course covers more advanced computer hardware architecture in order to understand computer performance and how to make the computer execute faster.

Achievement at this intermediate level will be specifically demonstrated through the following:

- Appropriate competency in the hardware component of Computer Science core content; (SLO 3)

Topics (Numbers in parenthesis are chapter/section numbers in the textbook.)

1. Computer abstractions and technology (1).
    - Under the cover
    - Performance
    - Power wall
    - Multiprocessors
2. Instructions: Language of the Computer (2).
    - MIPS instructions
    - Supporting procedures
    - MIPS addressing
    - Parallelism and instructions: synchronization
    - Starting a program
3. Arithmetic for Computers (3).
    - Addition and subtraction
    - Multiplication and division
    - Floating point
    - Parallelism and arithmetic: subword parallelism
4. The Processor (4).
    - Datapath
    - Pipelined datapath and control
    - Data hazards: forwarding versus stalling
    - Control hazards
    - Exceptions
    - Parallelism via instructions
5. Large and Fast: Exploiting Memory Hierarchy (5).
    - Memory technologies
    - Caches
    - Virtual machines
    - Virtual memory
    - Parallelism and memory
6. Parallel Processors from Client to Cloud (6).
    - Parallel processing programs
    - Multithreading
    - Multicore
    - Shared memory multiprocessors
    - Message-passing multiprocessors

Requirements and Evaluation

Tests: 2 Midterms: Monday April 22 and Wednesday May 15. Final: Wednesday June 12, 2024, 11:00 a.m. – 1:00 p.m.

Homework assignments: There will be approximately one homework assignment every week. These assignments must be turned in at the beginning of the class period on the given due date. Late assignments are not accepted unless you have a medical or emergency excuse.

Final project: MIPS simulation. Extra credit if you do forwarding also.

Attendance and Class Participation

This course will include much discussion. Students are expected to be on-time for class and ready to actively engage the material. Proper class preparation, active participation in class, and thoughtful conversation on the topic being discussed are expected. Since so much of what we learn takes place in dialogue with each other, the presence of each student is valued and necessary at every class period. To be excused from a class, you must provide an official note documenting the reason(s) for your absence. It is still your responsibility to catch up on any material that you have missed.

Grading

Homework 20%, Final project 20%, Midterms 2 @ 20% each, Final 20%.

Grading Scale

After the grades for the above requirements and their percentages have been calculated for each student, the final grades will be based on the following scale:

95 – 100%	A
90 – 94.9%	A-
87 – 89.9%	B+
83 – 86.9%	B
80 – 82.9%	B-
77 – 79.9%	C+
73 – 76.9%	C
70 – 72.9%	C-
67 – 69.9%	D+
60 – 66.9%	D
0 – 59.9%	F

“Incomplete” grades are given only in extremely unusual circumstances. See *La Sierra University Undergraduate Bulletin* for the University’s policy concerning required procedures and course completion.

Policy on Assistance for Physically and Learning Challenged Students

La Sierra University complies with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973. The Office of Disability Services located in the Learning Support and Testing Center coordinates all student requests for accommodation relating to special needs (physical, learning, or psychological). A student with such needs should contact the

Office of Disability Services the first week of the quarter by calling 785-2450. After proper documentation is established, the instructor will meet with the student privately to discuss specific needs.

La Sierra University's Policy on Academic Integrity and Honesty

"Academic honesty is the cornerstone of institutional integrity. Academic dishonesty, on the other hand, is a threat to the intellectual fabric of an academic community and is, perhaps, the most serious violation of trust that can occur in a community of scholars and educators…. Students who commit any offense against academic integrity and honesty may receive from an instructor a failing grade in an assignment or a failing grade in a course, without possibility of withdrawal. The nature of the offense may dictate probation, suspension, dismissal, or permanent expulsion as determined by the dean and the Administrative Committee of the student's school of enrollment" (*La Sierra University Undergraduate Bulletin*).

Faculty members are expected to report all incidents of academic dishonesty. The instructor for this course will follow the established protocol for faculty members, which includes a report to the Provost's office should such an incident occur.

To be sure that you have no misunderstandings about the definitions of academic honesty or academic dishonesty, refer to your *La Sierra University Student Handbook*. The University has significant penalties for academic dishonesty, so please take this suggestion seriously.La Sierra University's policy and other important information regarding academic honesty can be found at http://www.lasierra.edu/departments/psychology/AIC/

Important Dates

4/12 (Last day to withdraw with no record on transcript), 5/24 (Last day to withdraw with a "W"), 5/27 (Memorial Day holiday).